

Earth Science Week October 10-16, 2010

Capture an Image of Energy at Work!

This year's Earth Science Week 2010 theme is "Exploring Energy." Visit our website to discover and learn more about the Earth's energy resources. Energy can be put into two major categories: potential and kinetic. It occurs in different forms including: chemical, mechanical, nuclear, gravitational, electrical, radiant, thermal, motion, and sound.

Find more ways to engage students in learning about energy by going to:

<http://usgs.gov/esw>



Introduction

Changes taking place today, like all changes throughout time, require energy. Energy makes change; it does things for us and to the world around us. The history of Earth and its inhabitants, and the story of Earth processes are really part of the story of energy and of change. The energy sources we use today include: water, coal, petroleum, gas, nuclear, solar, wind, geothermal, and biofuels. But what actually is energy?

Although we can't actually see energy itself, we can see and describe the effects of energy.

Because we can only see the effects of energy, in the language of science, we say "energy is the ability to do work." We thought it would be fun to see if students could capture a picture to observe and describe energy's "ability to do work" at home or someplace in their community.

As energy comes in many forms and can be converted from one form into another, it would also be fun to see if students could identify how many forms of energy are represented in the world around them. The following tables of information are provided to help.

POTENTIAL ENERGY is stored energy and the energy of position, such as gravitational energy. There are several forms of potential energy.

KINETIC ENERGY is the energy of motion — of waves, molecules, substances, and objects.

Definitions of the different forms of the energy are courtesy of the National Energy Education Development (NEED) Project.

Forms of Potential Energy

Chemical Energy is energy stored in the bonds of atoms and molecules. Biomass, petroleum, natural gas, and coal are examples of stored chemical energy. Chemical energy is converted to thermal energy when we burn wood in a fireplace or burn gasoline in a car's engine.

Example: Consider the ability of your body to do work. The glucose (blood sugar) in your body is said to have “chemical energy” because the glucose releases energy when chemically reacted (combusted) with oxygen. Your muscles use this energy to generate mechanical force and also heat.

Mechanical Energy is energy stored in objects by tension.

Examples: Compressed springs and stretched rubber bands are examples of stored mechanical energy.

Nuclear Energy is energy stored in the nucleus of an atom — the energy that holds the nucleus together. Very large amounts of energy can be released when the nuclei are combined or split apart. Nuclear power plants split the nuclei of uranium atoms in a process called fission.

Examples: The sun combines the nuclei of hydrogen atoms in a process called fusion. In the interior of the Earth, uranium nuclei (and certain other heavy elements) split apart, in a process called fission. In this process energy is released.

Forms of Kinetic Energy

Electrical energy is delivered by tiny charged particles called electrons, typically moving through a wire.

Example: Lightning is an example of electrical energy in nature, so powerful that it is not confined to a wire.

Radiant Energy is electromagnetic energy that travels in transverse waves. Radiant energy includes visible light, x-rays, gamma rays and radio waves. Light is one type of radiant energy. Sunshine is an example of radiant energy, and provides the fuel and warmth that make life on Earth possible.

Example: Green plants absorb radiant energy of the Sun in a process called photosynthesis. With sunlight, green plants in a chemical reaction combine carbon dioxide and water to make sugar and oxygen. The chemical energy in plants gets passed on to animals that eat them.

Thermal Energy, or heat, is the vibration and movement of the atoms and molecules within substances. As an object is heated up, its atoms and molecules move and collide faster. Geothermal energy is the thermal energy in the Earth.

Example: Think of a hot cup of chocolate. The hot chocolate is said to possess “thermal energy”, or “heat energy” (The higher the temperature, the faster the molecules are moving around and/or vibrating).

Gravitational Energy is energy stored in an object's height. The higher and heavier the object, the more gravitational energy is stored.

Example: When you ride a bicycle down a steep hill and pick up speed, the gravitational potential energy is being converted to motion energy (also called kinetic energy). A rock perched high on the side of a cliff, contains gravitational potential energy, but if it breaks free this potential energy will be converted motion/kinetic energy. Water, in a reservoir behind a dam, is an example of gravitational potential energy, but it too can be converted to motion/kinetic energy when it flows over or through the dam.

Motion Energy is energy stored in the movement of objects. The faster they move, the more energy is stored. It takes energy to get an object moving and energy is released when an object slows down.

Examples: Wind is an example of motion energy. A dramatic example of motion is a car crash, when the car comes to a total stop and releases all its motion energy at once in an uncontrolled instant.

Sound Energy is the movement of energy through substances in longitudinal (compression/rarefaction) waves. Sound is produced when a force causes an object or substance to vibrate — the energy is transferred through the substance in a wave. Typically, the energy in sound is far less than other forms of energy.

Example: Sound waves are compression waves associated with the potential and kinetic energy of air molecules. When an object moves quickly, for example a vibrating sound speaker, it compresses the air nearby, giving that air potential energy. That air then expands, transforming the potential energy into kinetic energy (moving air). The moving air then pushes on and compresses other air, and so on down the chain.